MATH 326: Homework 10 SPRING 2013

- 1. Suppose that I wish to start a new diet consisting of Raman noodles, ice cream (from Ferdinand's) and salad (from the Broiler). Each serving of Raman noodles costs \$1. Each serving of ice cream costs \$2 and each serving of salad costs \$2. Suppose that I wish to consume at least 2 servings of salad per day (for vegetables). I also wish to consume at least 1400 calories and 20 grams of protein. Each serving of Raman noodles contains 200 calories and contains 5 grams of protein. Each serving of salad contains 100 calories and 1 gram of protein. Assume I want to minimize the amount per day I spend on food.
 - (a) Construct a linear programming problem whose solution will provide the optimal diet for me.
 - (b) Use the Big-M method to find a solution for the problem.
- 2. Consider the Big-M problem formulation:

$$P_M \begin{cases} \max & c^T x - M e^T x_a \\ \text{s.t.} & A x + I_m x_a = b \\ & x, x_a \ge 0 \end{cases}$$
(1)

We noted that for a minimization problem the objective function would be:

$$\min \quad c^T x + M e^T x_a \tag{2}$$

We know that every maximization problem can be written as a minimization problem (and vice-versa). Show that equation (2) follows by changing Problem P_M into a minimization problem.

3. Use any method you like to show that the following linear programming problem is infeasible:

$$\begin{array}{ll} \min & -x_1 - 3x_2 + x_3 \\ \text{s.t.} & x_1 + x_2 + 2x_3 \leq 4 \\ & -x_1 + x_3 \geq 4 \\ & x_3 \geq 3 \\ & x_1, x_2, x_3 \geq 0 \end{array}$$